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**National Oceanic and Atmospheric Administration**
NATIONAL MARINE FISHERIES SERVICE
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# BAITFISH-TRANSPORT PROJECT--A PROGRESS REPORT

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The annual landings of the Hawaiian fishery for skipjack tuna, Katsuwonus pelamis, which average in excess of $2 million in ex-vessel value, experience considerable fluctuations from year to year. The annual landings fluctuate between 5 and 16 million pounds and average around 9 million pounds. One of the important causes in the fluctuation of the landings is the shortage of live bait. The seasonal availability of nehu, Stolephorus purpureus, the most important native baitfish, varies greatly, but in general, the supply is insufficient to allow maximum fishing effort by the existing fleet. The shortage of bait is particularly acute during the peak skipjack tuna fishing season, from around May to September, when many of the boats spend considerable time searching for and catching bait needed to fish skipjack tuna.

A solution to the baitfish problem which would replace time spent catching bait with additional fishing time could increase the annual catch by as much as 66% and provide for an increase in ex-vessel value of the catch of $1.9 million. Various solutions have been proposed and researched in the past. The culture of live bait has been tried and to date the results have shown the baitfish to be either too expensive or the cultured baitfish has been unacceptable to the fishermen. Another approach has been the development of artificial bait, e.g., various types of odor-impregnated food pellets. All of these were found to be ineffective.

One of the most direct and feasible approaches to the problem is to bring in a supply of baitfish from areas where they are readily available. In Hawaii's situation, the northern anchovy, Engraulis mordax, from California seems a good possibility. The northern anchovy has been transported to Hawaii in the past on several occasions, mostly on an opportunistic basis and in small quantities. All indications are that this species is hardier than the nehu and would allow the Hawaiian tuna boats to range farther from base port than is now possible with the nehu. Further, the northern anchovy has been used successfully in fishing for skipjack tuna in the central Pacific and it is one of the principal baitfishes used by the tuna bait boats in the eastern Pacific. Consequently, a program was conceived to develop the technology needed for the transportation, holding and ancillary requirements to the successful importation of live northern anchovy from California to Hawaii.

Briefly, the program will be executed in four phases. Phase 1 will encompass a preliminary review and assessment of various baitfish transport alternatives. Phase 2 will test the feasibility of transporting live bait using the alternative assessed to be most promising. Phase 3 will involve the development of a full-scale system of economically transporting bait to Hawaii on a sustaining basis--a system that would supply all of the baitfish needs of the Hawaiian fleet. Phase 4 will comprise report writing.

Phase 1 of the program has already been completed. In this phase, entitled the preliminary baitfish engineering study (moving baitfish from California to Hawaii), several alternative methods of transporting bait from California to Hawaii were considered. This study indicated that the most feasible method of transporting live baitfish would be the development of a bait-tank truck with a self-contained life support system. This system takes advantage of the recently developed roll-on-roll-off system of cargo handling instituted by the Matson Navigation Company on their new vessel, the Lurline. Although this system of moving live bait will still require the solution of many problems, it was concluded that this was the most promising method among the various alternatives considered.

Laboratory personnel are now actively engaged in Phase 2, which will test the feasibility of the bait-tank truck and roll-on-roll-off freighting system. A Navy surplus aircraft refueling tank with a capacity of 5,000 gallons was selected for the prototype that will be developed. During the latter part of the year (1973) detailed plans were developed for the life support system of the bait transportation tank. Plans for the life support system include the installation of a high capacity water pump, aerators, and an oxygen monitoring apparatus. Simultaneously, work has been progressing on the conversion of the interior of the fuel tank to make it more compatible with bait carrying requirements. The interior of the tank is being thoroughly cleaned and coated with a non-toxic resin so that there will be no residual toxic material. As matters now stand, it is anticipated that the life support module will be assembled and installed and ready for testing by February 1974. The life support system will be tested by experimentally holding and hauling threadfin shad, Dorosoma petenense, caught at Wahiawa Reservoir in mid-February. Hopefully, the tank will be shipped to California in late February and a trial shipment of northern anchovy be made in March.

In addition to the work required to develop the prototype bait transportation tank, various people were involved in other related activities. In California, arrangements and details are being worked out for the purchase of northern anchovy from established bait dealers. Bait dealers in Los Angeles Harbor and San Diego were contacted for preliminary discussions. Officials of the California Department of Fish and Game were also contacted. There apparently are no legal barriers to any part of the proposed operations as far as the State of California is

concerned. Discussions with officials of Matson Navigation Company in California and Hawaii have indicated that it will be feasible to utilize the roll-on-roll-off system of the Lurline to transport the tank between California and Hawaii. Agreement on details on freight rates and shipping conditions between our Laboratory and Matson Navigation Company is close at hand.

Experiments were conducted at the La Jolla Laboratory of the Southwest Fisheries Center on the oxygen requirements of northern anchovy. This information was of vital importance to the development of the life support system for anchovy transport. The experiments were to determine the oxygen consumption of northern anchovy at temperatures comparable to what might be expected during the crossing from California to Hawaii, i.e., at temperatures of 15°-16°C and up to 28°C. The results of these experiments generally corroborated what we expected relative to anchovy respiration at the various temperatures. At 15°C, oxygen consumption averaged 0.322 ml/g/h. This was higher than anticipated, probably due to high activity rates at the outset of the experiment. At 27°C the consumption was 0.532/ml/g/h. Thus, water and oxygen requirements are about what we had anticipated. In an open system, 200 buckets of anchovy will require a minimum of 368 gallons of water per minute at 27°C to survive.

A systematic sampling of water to monitor oxygen level, salinity, and temperature in several locations in Keehi Lagoon, Honolulu Harbor, and Kewalo Basin has been underway for about 2 months. These data will help determine the best locations to install our baitfish holding facilities once the full-scale program is underway.

Finally, although it is believed that this program will have no adverse impact on the environment, a "discussion paper" on the possible environmental impact of importing northern anchovy into Hawaii was prepared. Briefly, the accumulated knowledge on the biology of the northern anchovy suggests that this species will not become established in Hawaiian waters. Temperature and habitat requirements of the northern anchovy are not found in Hawaiian waters, thus making it unlikely that a reproducing population of northern anchovies will become established in Hawaii.

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